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THE PREPARATION OF SPECIFICATIONS FOR PETROLEUM PRODUCTS

BY

IRVING C. ALLEN

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CONTENTS.

	Page.
Introduction	3
Importance of properly prepared specifications	3
History of the International Petroleum Commission	4
The International Petroleum Congress	4
Origin and status of the International Petroleum Commission	5
The Vienna meeting of the commission	6
The New York meeting	7
Procedure followed by the commission	8
Work of the Bureau of Mines	8
Points to be considered in testing and products for which specifications are desirable	9
Publications on fuel technology	10

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THE PREPARATION OF SPECIFICATIONS FOR PETROLEUM PRODUCTS.

By Irving C. Allen.

INTRODUCTION.

In connection with the analyses and tests of fuels belonging to or for the use of the Government the Bureau of Mines has found it necessary to undertake the preparation of specifications for the purchase of petroleum and its products. These specifications will be published by the bureau for the information of Government officials and of dealers in petroleum products. This paper discusses in a general way the importance and the practicability of preparing such specifications.

IMPORTANCE OF PROPERLY PREPARED SPECIFICATIONS.

It seems to be the concensus of opinion among oil technologists that by making critical tests exact specifications for petroleum products can be prepared that will withstand the criticism of both the consumer and the refiner.

The reason for the opposition of some oil men to specifications is that in the past it was often the practice of a chemist with little knowledge of the origin of a product, and with less experience in its use, to formulate a specification. His information usually was derived from books and was inadequate, and the specification he prepared led only to confusion. But when men of experience, men who are actually using these products, begin to study critically their individual problems, the information they obtain will serve for the preparation of specifications that will be of much value. These men should make running tests covering as long a period of time as possible and should endeavor to ascertain which oil best answers their particular purpose. The characteristics of this oil should then be described precisely in scientific terms, and the tests themselves should be given in detail. By this method, and this method alone, can the particular properties of the oil desired be definitely ascertained.

Next the refiner should be consulted, in order that the history of the oil may be obtained, and an accurate description of its preparation in

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the refinery should be published as a basis for estimating the probability of the continued production of the oil in commercial quantities and at a reasonable price. Finally, the refiner and the consumer together should confer with the chemist or engineer who has had experience in scientific testing and who has at his disposal a well-equipped laboratory in which to make independent conformitory tests or even additional and more elaborate tests than are possible in the shop or refinery. By such procedure, and by such procedure only, can a specification be formulated that will be fair to the refiner and that will describe percisely the product desired.

Attempts to use an oil for too many purposes should not be made. There should be specialization. Certain oils should be used for certain purposes, as is the case with other products in the industries. For certain well-established and fundamental uses it is possible to ascertain, as has already been done in many instances, the particular oil that is best suited for a particular use. That special oil, together with the particular condition of use, should then be described in the most precise terms possible by the consumer, the refiner, and the man in the laboratory. By the cooperation of these three men, a specification can be prepared that will withstand all the criticism that may be thrown against it.

Scientific specifications should be based on physical and chemical, and on running tests in the refinery, in the shop, and in the laboratory. The tests themselves must be based on fundamental scientific principles, and therefore the methods of analysis must be uniform, and the results obtained by the instruments used in testing must, so far as possible, be independent of the personal peculiarities of the operator.

In a word, the establishment of scientific uniformity in methods of analysis and in instruments used must precede the formulation of specifications. With such uniformity in view, the petroleum technologists of Europe have formed an association called the International Petroleum Commission. A brief outline of its history and organization is given below.

HISTORY OF THE INTERNATIONAL PETROLEUM COMMISSION.

THE INTERNATIONAL PETROLEUM CONGRESS.

From information gathered from various sources in this country and abroad the author has come to believe that through the activity of Dr. Paul Dvorkovitz, editor of The Petroleum Review, an open invitation was sent, early in 1900, to many men interested in the petroleum industry, inviting them to meet at the International Exposition in Paris in 1900 for the purpose of discussing all problems pertaining to the petroleum industry.

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As a result of this invitation, a number of men met and formed the International Petroleum Congress, which opened the way for the discussion of all matters pertinent to the petroleum industry. Uniform methods of testing petroleum products were discussed. Little of a definite nature, however, was accomplished at that time.

The second meeting of this congress was held at Liege, Belgium, in 1905. At this meeting it was shown that the greatest difficulty in the way of international cooperation in methods of testing was the great diversity of opinion among different individuals and governments and the lack of uniformity in the methods already in use. An international subcommission was appointed to eliminate these misunderstandings but accomplished no material result, and at the following congress in Bucharest this subcommission did not convene.

The International Petroleum Congress met for the third time in Bucharest, Roumania, in 1907, where an international commission for uniform methods of testing petroleum products was appointed. This commission consisted of nineteen members representing eleven nations. It reached no definite conclusions during the congress, but, unlike the previous subcommission, it continued in existence and made definite progress in the right direction.

The congress did no other business of importance. This commission, however, primarily through the efforts of the general secretary, Dr. L. Ubbelohde, of Karlsruhe, Germany, continued active and convened in London in 1910. Here uniform methods of testing were again discussed, but again without definite action. Also, a resolution to consider methods of transportation and storage was passed, but later was rescinded.

ORIGIN AND STATUS OF THE INTERNATIONAL PETROLEUM COMMISSION.

Through the continued activity of Dr. Ubbelohde, between 1907 and 1912, "national sections" were formed in Europe to meet in Karlsruhe (date not set) and form the "head commission." The intent of Dr. Ubbelohde presumably was that this "head commission" would assume all the duties of the original international congress and gradually replace it. He has stated that in order to bring the interests of any particular country to a focus these national sections are advisable and are necessary to an international congress. Dr. Ubbelohde has been the active force of this organization, and it is due primarily to his work that this commission has continued in existence.

The International Petroleum Congress had no official status, was simply called together by Dr. Dvorkovitz, and its conclusions were recommendations only and bound no one. Its functions are being assumed by this "head commission" because of a lack of activity by

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the international congress on the one hand and because of the activity on the other hand of the general secretary in forming the new "head commission," having aims identical with those of the original congress.

The commission in this manner continued in existence and met again in Vienna, Austria, in January, 1912. At that meeting methods of testing were discussed and certain tests for kerosene and lubricants were adopted.

THE VIENNA MEETING OF THE COMMISSION.

The commission met on January 17 in the hall of the Architects' Club. The assembled delegates, 105 in all, for the most part represented industrial organizations or scientific societies. Only a minority officially represented governments. The 105 delegates were from 16 nations, as follows: Bulgaria, 1; Germany, 12; England, 1; France, 3; Italy, 3; The Netherlands, 2; Norway, 2; Roumania, 4; Russia, 1; Sweden, 1; Switzerland, 1; Servia, 1; Spain, 1; Austria-Hungary, 70; United States, 2.

The opening session of the commission was devoted to addresses of welcome and responses, and to the reading of scientific papers. At the adjournment of this session, the commission, without formal authorization or consideration of new lines of work, separated into three sections to consider: (1) Uniform methods of testing, (2) nomenclature or scientific definition, and (3) fire dangers, storage, and transportation. It was found convenient to have the first and second sections meet together. A discussion of the scientific definition of petroleum terms resulted in no formal action, however, except the appointment of a committee to formulate a glossary stating the equivalent French, German, and English forms of various terms used in petroleum technology; in other words, to compile an international dictionary of petroleum products. The subject of nomenclature was given no further consideration.

In the sessions of the first section, dealing with uniform methods of testing, the time apportioned to various subjects was not commensurate with the relative importance of each and there was considerable confusion during discussion. For example, about one hour was given to debating methods of examining the odor of petroleum products, although all the delegates accepted the opinion that such a test is of negligible importance. On the other hand, the entire subject of distillation tests was given little more time, although its paramount importance was recognized. However, some valuable discussions resulted, although a large amount of work remains to be done. Certain testing methods, especially those for lubricating oils and asphalts, were referred to subcommittees for further consideration and for report at a future meeting of the commission.

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A session of the third section, for the consideration of matters affecting storage and transportation, developed strong interest on the part of various delegates from European countries, especially Germany and Austria, with the result that this section brought into the general meeting on the second day a proposition to establish the section on transportation and storage as a definite feature of the work of the commission. The discussion developed the fact that the general sentiment of the commission favored the practical abandoning of the plan of absolute international agreement on methods of testing, and the commission was converted into an advisory society, without the advice which it might give being internationally obligatory. To carry out this plan, the majority voted to change the name of the subcommittee of the International Petroleum Congress to the International Petroleum Commission, and to make the object the study of all matters concerning petroleum and its products that might be brought before the commission, in the hope that any country or commercial interest would take from the proceedings of the commission such advice as it might think valuable.

As indicated above, the character of the commission was changed by the work of this session from a subcommittee to consider uniform methods of testing only, into a permanent International Petroleum Commission, somewhat in the nature of a scientific society, for the discussion, without definite international obligations, of all subjects connected with petroleum. In a word, the International Petroleum Commission, the creature of the International Petroleum Congress, assumed at its own volition the duties of the congress. This International Petroleum Commission is composed of the best-informed petroleum chemists and experts in Europe. Although the representation is not equitably apportioned among the nations producing and refining crude petroleum or consuming petroleum products, yet, in view of the public standing of its members, the commission hopes that all persons in the United States who are interested in the testing of petroleum and its products will, as far as possible, work in harmony with it and will cooperate in increasing the general knowledge of petroleum technology and in endeavoring to improve the conditions of manufacture, transport, and storage of all petroleum products.

THE NEW YORK MEETING.

At the last session of the Vienna meeting the delegates from the United States invited the commission to meet as part of the section on fuels and asphalts of the Eighth International Congress of Applied Chemistry. This congress held sessions in New York in September, 1912. A number of members of the commission presented papers, but because of the broad scope of the congress it was deemed inadvisable to hold independently sessions of the petroleum commission

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itself. There was held, however, a special session of the commission at the Chemists' Club, New York, on September 7, to which the public was invited and at which the organization and aims of the commission were presented. A number of men prominent in petroleum technology spoke on the importance of petroleum testing in general, although there was no discussion on the technical details of testing. The next session of the International Petroleum Commission will be held at Bucharest, Roumania, in April, 1913.

PROCEDURE FOLLOWED BY THE COMMISSION.

The general method of procedure of the commission in considering methods of tests is as follows:

Each national committee convenes and discusses locally its methods of tests and so far as possible comes to an agreement regarding them. The chosen representatives of these local committees meet with the international commission, and there the recommendations collectively are again discussed, and so far as possible an agreement is reached and the recommendations are made public.

WORK OF THE BUREAU OF MINES.

Realizing the importance of the work undertaken by the commission, the Bureau of Mines, in its efforts to increase efficiency in the utilization of petroleum products belonging to or for the use of the Government, has undertaken the preparation of specifications for certain petroleum products purchased by the Government. The preparation of such specifications is deemed necessary because of the wide differences of opinion among manufacturers and consumers of these products and because of the lack of uniformity in the specifications now in use.

The preparation of scientific specifications for petroleum products is difficult, necessitates a large amount of critical research, and requires a considerable time for completion.

It was believed that the preparation of these specifications, in fairness to all concerned, could be best carried out by obtaining the cooperation of competent men, each of whom has had training in research work and has available a well-equipped laboratory. This work, therefore, is being done in cooperation with committees of the American Chemical Society, the American Society for Testing Materials, the National Petroleum Association, the National Fire Protection Association, the International Petroleum Commission, and a number of universities, and the Director of the Bureau of Mines has communicated with a large number of prominent chemists and engineers throughout the United States, soliciting their cooperation and advice. The answers have been most encouraging and there is now being or-

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ganized a number of committees to carry on the testing. It is hoped to have these committees hold a joint meeting in the near future, when an association can be formed for the cooperative testing of petroleum products.

By these careful methods of cooperative testing it is hoped soon to describe petroleum products of all kinds, and to describe them in such definite terms that the products can be reproduced by reputable refiners and be purchased by the public in the open market.

POINTS TO BE CONSIDERED IN TESTING AND PRODUCTS FOR WHICH SPECIFICATIONS ARE DESIRABLE.

Below are given (*a*) a tentative list of those fundamental factors to be considered in petroleum testing that should be definitely settled before specifications for particular products can be logically considered, and (*b*) a list of the petroleum products for which it is desirable to prepare specifications. The Bureau of Mines is primarily concerned only with products belonging to or for the use of the Government.

(*a*) Fundamental factors to be considered in petroleum testing:

1. Color, fluorescence.
2. Odor.
3. Taste.
4. Specific weight.
5. Coefficient of expansion.
6. Flame or flash point.
7. Fire or burning point.
8. Viscosity or capallarity.
9. Solidifying properties or fluidity at low temperatures.
10. Softening and melting points, or pentrometry.
11. Solubility.
12. Calorific value.
13. Distillation, boiling-point ranges.
14. Degree of refining.
15. Elementary composition.
16. Water content.
17. Sulphur content.
18. Paraffin content.
19. Asphaltum content.
20. Coke or free carbon content.
21. Ash content.
22. Acidity.
23. Photometric value.
24. Burning properties.
25. Carbonization.
26. Stability on storing, resistance to light and heat.
27. Stability under steam and friction treatment.
28. Tests for foreign oils.
29. Oxygen-absorption properties, or resistance to oxidation.
30. Electric conductivity or insulating properties.

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(*b*) Methods and petroleum products for which it is desirable to prepare specifications:

1. Sampling methods for oils and gases.
2. Gasolines.
3. Benzines and naphthas.
4. Lamp oils, kerosenes, miners' oils, and torch greases.
5. Paint-oil substitutes.
6. Lubricating oils and greases.
7. Paraffins.
8. Asphaltums and bitumens.
9. Preserving and protective bitumens.
10. Paint bitumens.
11. Pavement bitumens.
12. Road oils.
13. Fuel oil for steam boilers and for internal-combustion engines.
14. Studge products; tars.
15. Cokes.

PUBLICATIONS ON FUEL TECHNOLOGY.

The following Bureau of Mines publications may be obtained free by applying to the Director, Bureau of Mines, Washington, D. C.:

BULLETIN 1. The volatile matter of coal, by H. C. Porter and F. K. Ovitz. 1910. 56 pp., 1 pl.

BULLETIN 2. North Dakota lignite as a fuel for power-plant boilers, by D. T. Randall and Henry Kreisinger. 1910. 42 pp., 1 pl.

BULLETIN 3. The coke industry of the United States as related to the foundry, by Richard Moldenke. 1910. 32 pp.

BULLETIN 4. Features of producer-gas power-plant development in Europe, by R. H. Fernald. 1910. 27 pp., 4 pls.

BULLETIN 5. Washing and coking tests of coal at Denver, Colo., July 1, 1908, to June 30, 1909, by A. W. Belden, G. R. Delamater, J. W. Groves, and K. M. Way. 1910. 62 pp.

BULLETIN 6. Coals available for the manufacture of illuminating gas, by A. H. White and Perry Barker; compiled and revised by H. M. Wilson, 1911. 77 pp., 4 pls.

BULLETIN 7. Essential factors in the formation of producer gas, by J. K. Clement, L. H. Adams, and C. N. Haskins. 1911. 58 pp., 1 pl.

BULLETIN 8. The flow of heat through furnace walls, by W. T. Ray and Henry Kreisinger. 1911. 32 pp.

BULLETIN 12. Apparatus and methods for the sampling and analysis of furnace gases, by J. C. W. Frazer and E. J. Hoffman. 1911. 22 pp.

BULLETIN 13. Résumé of producer-gas investigations, October 1, 1904, to June 30, 1910, by R. H. Fernald and C. D. Smith. 1911. 393 pp., 12 pls.

BULLETIN 14. Briquetting tests of lignite, at Pittsburgh, Pa., 1908–9; with a chapter on sulphite-pitch binder, by C. L. Wright. 1911. 64 pp., 11 pls.

BULLETIN 16. The uses of peat for fuel and other purposes, by C. A. Davis. 1911. 214 pp., 1 pl.

BULLETIN 18. The transmission of heat into steam boilers, by Henry Kreisinger and W. T. Ray. 1912. 180 pp.

BULLETIN 19. Physical and chemical properties of the petroleums of the San Joaquin Valley, Cal., by I. C. Allen and W. A. Jacobs, with a chapter on analyses of natural gas from the southern California oil fields, by G. A. Burrell. 1911. 60 pp., 2 pls.

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BULLETIN 21. The significance of drafts in steam-boiler practice, by W. T. Ray and Henry Kreisinger. 64 pp. Reprint of United States Geological Survey Bulletin 367.

BULLETIN 23. Steaming tests of coals and related investigations, September 1, 1904, to December 31, 1908, by L. P. Breckenridge, Henry Kreisinger, and W. T. Ray. 1912. 380 pp., 2 pls.

BULLETIN 24. Binders for coal briquets, by J. E. Mills. 56 pp. Reprint of United States Geological Survey Bulletin 343.

BULLETIN 27. Tests of coal and briquets as fuel for house-heating boilers, by D. T. Randall. 44 pp., 3 pls. Reprint of United States Geological Survey Bulletin 366.

BULLETIN 28. Experimental work conducted in the chemical laboratory of the United States fuel-testing plant at St. Louis, Mo., January 1, 1905, to July 31, 1906, by N. W. Lord. 51 pp. Reprint of United States Geological Survey Bulletin 323.

BULLETIN 29. The effect of oxygen in coal, by David White. 80 pp., 3 pls. Reprint of United States Geological Survey Bulletin 382.

BULLETIN 30. Briquetting tests at the United States fuel-testing plant at Norfolk, Va., 1907–8, by C. L. Wright. 41 pp., 9 pls. Reprint of United States Geological Survey Bulletin 385.

BULLETIN 31. Incidental problems in gas-producer tests, by R. H. Fernald, C. D. Smith, J. K. Clement, and H. A. Grine. 29 pp. Reprint of United States Geological Survey Bulletin 393.

BULLETIN 32. Commercial deductions from comparisons of gasoline and alcohol tests on internal-combustion engines, by R. M. Strong. 38 pp. Reprint of United States Geological Survey Bulletin 392.

BULLETIN 33. Comparative tests of run-of-mine and briquetted coal on the torpedo boat *Biddle*, by W. T. Ray and Henry Kreisinger, 50 pp. Reprint of United States Geological Survey Bulletin 403.

BULLETIN 34. Tests of run-of-mine and briquetted coal in a locomotive boiler, by W. T. Ray and Henry Kreisinger. 33 pp. Reprint of United States Geological Survey Bulletin 412.

BULLETIN 35. The utilization of fuel in locomotive practice, by W. F. M. Goss. 29 pp. Reprint of United States Geological Survey Bulletin 402.

BULLETIN 37. Comparative tests of run-of-mine and briquetted coal on locomotives, including torpedo-boat tests, and some foreign specifications for briquetted fuel, by W. F. M. Goss. 58 pp., 4 pls. Reprint of United States Geological Survey Bulletin 363.

BULLETIN 39. The smoke problem at boiler plants; a preliminary report by D. T. Randall. 31 pp. Reprint of United States Geological Survey Bulletin 334, revised by S. B. Flagg.

BULLETIN 40. The smokeless combustion of coal in boiler furnaces, with a chapter on central heating plants, by D. T. Randall and H. W. Weeks. 188 pp. Reprint of United States Geological Survey Bulletin 373, revised by Henry Kreisinger.

BULLETIN 41. Government coal purchases under specifications, with analyses for the fiscal year 1909–10, by G. S. Pope, with a chapter on the fuel-inspection laboratory of the Bureau of Mines, by J. D. Davis. 1912. 97 pp., 3 pls.

BULLETIN 43. Comparative fuel values of gasoline and denatured alcohol in internal-combustion engines, by R. M. Strong and Lauson Stone. 1912. 243 pp., 3 pls.

BULLETIN 49. City smoke ordinances and smoke abatement, by S. B. Flagg. 1912. 55 pp.

TECHNICAL PAPER 1. The sampling of coal in the mine, by J. A. Holmes. 1911. 16 pp.

TECHNICAL PAPER 2. The escape of gas from coal, by H. C. Porter and F. K. Ovitz, 1911. 14 pp.

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TECHNICAL PAPER 3. Specifications for the purchase of fuel oil for the Government, with directions for sampling oil and natural gas, by I. C. Allen. 1911. 13 pp.

TECHNICAL PAPER 5. The constituents of coal soluble in phenol, by J. C. W. Frazer and E. J. Hoffman. 1912. 20 pp., 1 pl.

TECHNICAL PAPER 8. Methods of analyzing coal and coke, by F. M. Stanton and A. C. Fieldner, 1912. 21 pp.

TECHNICAL PAPER 9. The status of the gas producer and of the internal-combustion engine in the utilization of fuels, by R. H. Fernald. 1912. 42 pp.

TECHNICAL PAPER 10. Liquefied products from natural gas; their properties and uses, by I. C. Allen and G. A. Burrell. 1912. 23 pp.

TECHNICAL PAPER 16. Deterioration and spontaneous combustion of coal in storage, a preliminary report, by H. C. Porter and F. K. Ovitz. 1912. 14 pp.

TECHNICAL PAPER 20. The slagging type of gas producer with a brief report of preliminary tests, by C. D. Smith. 1912. 14 pp., 1 pl.

TECHNICAL PAPER 25. Methods for the determination of water in petroleum and its products, by I. C. Allen and W. A. Jacobs, 1912. 13 pp.

TECHNICAL PAPER 26. Methods of determining the sulphur content of fuels, especially petroleum products, by I. C. Allen and I. W. Robertson. 1912. 13 pp.

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